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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/537,618
Filing Date: June 03, 2005
Appellant(s): THORNE ET AL.

Edward W. Goodman
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 26 September 2007 appealing from the Office action mailed 2 May 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct.

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner: the 35 U.S.C. 101 rejection of claims 1-25.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,424,486	**Aoki**	**06-1995**
6,057,502	**Fujishima**	**05-2000**

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-14 & 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki (U.S. Patent No. 5,424,486, hereafter '486) in view of Fujishima (U.S. Patent No. 6,057,502, hereafter '502).

Claims 1 & 15: '486 teaches a method for determining the key of an audio signal on the basis of chord information (see title & abstract) and outputting a signal representing the determined key (see abstract: "it is allowed to make a musical key determination"), but does not explicitly teach that the method includes the steps of:

> for each of a plurality of signal portions of the audio signal, analyzing the signal portion to identify a musical note, and where at least one musical note is identified: determining a strength associated with the or each musical note; and generating a data record containing the identity of the or each musical note, the strength associated with the or each musical note and the identity of the portion;
>
> for each of the data records, ignoring the strength associated with an identified musical note where said strength is less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records;
>
> determining a first note from the identified musical notes as a function of their respective strengths;
>
> selecting at least a second and a third note from the identified musical notes as a function of the first note; or
>
> determining the key based on a comparison of the respective strengths of the at least second and third notes.

'502 teaches a method for recognizing chords, including the steps of:

for each (see Fig. 2, step SM8) of a plurality of signal portions (column 6, lines 60-67: "fractions or slices of a predetermined length"; column 7, lines 61-63: "waveform

slices"), analyzing the portion to identify a musical note (column 2, lines 42-56: "a time fraction of a musical sound wave is first analyzed into frequency components in the form of a frequency spectrum having a number of peak energy levels"), and where at least one musical note is identified (in column 2, lines 42-56, "peak energy levels" of the frequency spectrum correspond to notes; see Fig. 15(a) and column 14, lines 1-12: "the position of the C note, which is at 65.4 Hz, is indicated by a thin broken line in Fig. 15(a)"): determining a strength associated with the or each musical note (column 2, lines 42-56: "a musical sound wave is first analyzed into frequency components in the form of a frequency spectrum having a number of peak energy levels"); and generating a data record containing the identity of the or each musical note, the strength associated with the or each musical note and the identity of the portion (column 7, lines 44-45: "a profile...is stored in the predetermined area of the RAM;" see Fig. 15(a) and column 14, lines 1-12 for a description of a profile);

for each of the data records, ignoring the strength associated with an identified musical note where said strength is less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records (column 10, lines 38-52: "the amplitude levels of the frequency components which correspond to the respective musical note pitches are naturally larger than other frequency components (the levels of the actually existing notes are still more so) and are positioned at semitone intervals, and therefore, as the auto-correlated profiles P'n of a semitone step are accumulated one after another successively, the amplitude levels at the frequency positions corresponding to the notes will accordingly increase

prominently as compared with the rest of the positions. By adding together the levels of the frequency components at a semitone interval, the amplitude levels at the frequency positions corresponding to the respective musical notes becomes more prominent than the levels at other frequency positions, which clearly locates the note existing positions on the frequency axis;" see the two profiles in Fig. 11: the higher amplitude note positions seen in the profile at the top left are emphasized over the lower amplitude non-note positions seen in the profile at the top left in the profile seen at the bottom right; thus, this step results in ignoring the strength associated with an identified musical note where said strength is less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records);

determining a first note from the identified musical notes as a function of their respective strengths (column 10, lines 38-41: "the frequency positions corresponding to the respective musical notes becomes more prominent than the levels at other frequency positions, which clearly locates the note existing positions on the frequency axis"; see also Fig. 15(a), where notes have been identified through generating the profile shown);

selecting at least a second and a third note (see Fig. 15(a) where multiple peaks (multiple notes) are represented; see also Fig. 15(c) where the inner product of the generated profile (15(a)) and chord candidate profiles (each profile of Fig. 15(b)) results in three notes being clearly identified) from the identified musical notes as a function of the first note (column 10, lines 62-67 notes that all notes are functions of all other notes, in that a reference tone pitch, A4, is defined as 440 Hz; all other notes are inherently

"functions" of A4, in that they are based upon it (for example, if a note corresponds to 540 Hz, it is a function of A4 in that it is A4 (440 Hz) + 100Hz); and

determining the chord based on a comparison of the respective strengths of the at least second and third notes ('502 determines the chord based on a comparison of the respective strengths of the notes (column 7, lines 27-53: "step SM6 compares the profile PF produced through the above steps SM3-SM5 with the previously prepared chord patterns by means of a pattern matching method and calculates the point representing the degree of likelihood of being a candidate for the chord of the analyzed sound waveform. Then, the step SM7 records the determined chord with the calculated point in the RAM..."), and '486 determines the key on the basis of chord information (see: abstract)).

The chord-determining method of '502 increases the speed and accuracy of detecting chords (column 4, lines 1-2), decreases the possibility of noise frequency components affecting the detection of the chords (column 4, lines 13-27), and accounts for the case where the pitches of all the tones in the musical tune to be analyzed are deviated as a whole (column 4, lines 4-13). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the chord-determining method of '502 to have generated the chords necessary for determining the key in '486 in order to have increased the speed and accuracy of detecting chords, decreased the possibility of noise frequency components affecting the detection of the chords, and to have accounted for the case where the pitches of all the tones in the musical tune to be analyzed were deviated as a whole.

Claim 2: '502 teaches that each signal portion is the same size (column 8, lines 5-8: "step ST2 divides the sound waveform into fractions or slices in the time domain at the points of such measure heads and quarter notes, i.e. into slices of a quarter note duration;" see also column 6, lines 61-64: "the chord recognition processing divides the above sampled waveform data into fractions or slices of a predetermined length in the time domain").

Claim 3: '502 teaches that each signal portion encompasses the same length of time (column 8, lines 5-8: "step ST2 divides the sound waveform into fractions or slices in the time domain at the points of such measure heads and quarter notes, i.e. into slices of a quarter note duration;" see also column 6, lines 61-64: "the chord recognition processing divides the above sampled waveform data into fractions or slices of a predetermined length in the time domain").

Claim 4: '502 teaches that the size of the signal portion is a function of the tempo of the audio signal (column 8, lines 2-8: "the time division is conducted based on the note positions, in which a step ST1 determines the locations of measure heads and quarter notes using a conventional procedure, and then, a step ST2 divides the sound waveform into fractions or slices in the time domain at the points of such measure heads and quarter notes, i.e. into slices of a quarter note duration").

Claim 5: '502 teaches that the signal portions are contiguous (column 6, lines 60-64: "the chord recognition processing divides the above sampled waveform data into fractions or slices of a predetermined length in the time domain"; see also Fig. 2, step SM8: the entire waveform is divided up and processed, and as such, the signal

portions are contiguous; see also column 7, lines 4-9: "the next step SM2 reads out the waveform data of an amount for one time slice from the RAM in order to recognize chords of the divided time slices of the sound waveform successively (one time slice after another), steps SM3 through SM7 being repeated for the waveform data of each time slice").

Claims 6 & 16: '502 teaches that the predetermined fraction is determined in dependence on the content of the audio signal (column 10, lines 38-41: "amplitude levels of the frequency components which correspond to the respective musical note pitches are naturally larger than other frequency components (the levels of the actually existing notes are still more so);" see Fig. 11: depending on the variance of the amplitudes of the frequency components for each segment, the "predetermined fraction" will vary based on the content of the audio signal).

Claims 7 & 17: '502 teaches that the predetermined fraction lies in the range of one tenth to one half, because any note that doesn't have a high enough amplitude will get attenuated further by the peak enhancement and autocorrelation steps (outlined in columns 8-10) and then cut out completely in order for the chord to be determined (columns 12-14; see also Fig. 15). As a result, a quiet note (such as one of the smaller peaks in Fig. 15(a)) will be ignored (see Fig. 15(c)), especially if it has extremely low amplitude. Since a note of the smallest amplitude imaginable would be ignored in '502, musical notes which have a strength less than one tenth of the maximum strength associated with any identified musical note contained within the data records would be ignored.

Claims 8 & 18: '502 teaches that the predetermined fraction lies in the range of one tenth to one half, because any note that doesn't have a high enough amplitude will get attenuated further by the peak enhancement and autocorrelation steps (outlined in columns 8-10) and then cut out completely in order for the chord to be determined (columns 12-14; see also Fig. 15). As a result, a quiet note (such as one of the smaller peaks in Fig. 15(a)) will be ignored (see Fig. 15(c)), especially if it has extremely low amplitude. Since a note of the smallest amplitude imaginable would be ignored in '502, musical notes which have a strength less than one seventh of the maximum strength associated with any identified musical note contained within the data records would be ignored.

Claims 9 & 19: '502 teaches that the step of analyzing the signal portion to identify a musical note comprises the steps of:

converting the signal portion to a frequency domain representation (column 7, lines 10-11: "step SM3 performs an FFT processing of the read out waveform data of an amount of one time slice");

subdividing the frequency domain representation into a plurality of octaves (column 7, lines 17-21: "step SM4...folds the frequency spectrum on an octave span basis and superposes the respective frequency components in octaval relationship");

for each octave containing a maximum amplitude:

determining a frequency value at the maximum amplitude (this is necessarily accomplished by performing the FFT; see Fig. 6); and

selecting a note name of a musical scale in dependence on the frequency value (column 10, lines 62-67 teaches that frequency values correspond to note names; column 14, lines 1-12 teaches essentially the same thing: see Fig. 15(a)); and

identifying a musical note in dependence on the same note name being selected in more than one octave (column 7, lines 17-21 & column 8, lines 20-61; the frequency fold processing performs this step by folding/superposing the octave spans and then processing the superposed spans to identify notes that occur in more than one octave).

Claims 10 & 20: '502 teaches the method as claimed in claim 9, wherein the conversion of the signal portion to a frequency domain representation is performed by means of a Fourier Transform (column 7, lines 10-11: "FFT processing").

Claims 11 & 21: '502 teaches the method as claimed in claim 9, wherein the musical scale is the Equal Tempered Scale (column 10, line 64).

Claims 12 & 22: '502 teaches that the step of determining a strength associated with the or each musical note comprises the steps of: determining the amplitude of each frequency component of the musical note; and summing the amplitudes (column 8, lines 51-54: "the frequency components which are octavally related with each other are added together so that the frequency components of the same named notes in different octaves are added together").

Claims 13 & 23: '502 teaches that the step of determining the first note comprises the steps of: for each identified musical note, summing the strengths associated with the musical note in the data records (column 8, lines 51-54: "the frequency components which are octavally related with each other are added together

so that the frequency components of the same named notes in different octaves are added together"); and determining the first note to be the identified musical note with the maximum summed strength (all notes will be identified in the process of carrying out the FFT of column 7, line 10, including the note with the maximum summed strength; since all of the notes are compared to all of the other notes (see columns 12-14 & Fig. 15), any one note can be referred to as "a first note").

Claim 14: '502 teaches that the first note is the tonic of the key (see Fig. 15(a), 15(b) (C Major, etc.); the first note (C; on the right side of Fig. 15a) is the tonic of the key (C Major)).

Claim 24: '486 teaches that said apparatus further comprises an output device for sending data corresponding to the key of the audio signal (the bus, part 11).

Claim 25: '502 teaches a record carrier comprising software for causing a processor to carry out the method as claimed in claim 1 (column 15, lines 10-15).

(10) Response to Argument

Appellant argues that the combination of Aoki and Fujishima does not lead to the claim 1 limitation "determining the key by comparing the respective strengths of the at least second and third notes." Examiner disagrees. In '502, column 7, lines 27-53, the frequency spectrum of a music signal is analyzed in order to find peaks, which correspond to notes, in order to identify chords, which are combinations of 3 or more notes. First, the notes are compared in strength to find a peak (column 7, lines 27-42), and then enhanced octave profiles are compared in order to identify chords, thus again

comparing strengths of multiple notes to one another (see Fig. 15 & column 14, lines 1-58). '486 utilizes chords to identify the key (see abstract: "melody and chord information of a music piece are supplied" and "a musical key determination [is made]").

Appellant argues that Fujishima does not describe determining a first note or any one note, yet concedes that Fujishima indicates that "for the musical segment being analyzed, in the frequency spectrum, those frequency components which correspond with musical note pitches are larger than other frequency components." As can be seen in Fig. 15 of Fujishima, notes are clearly identified in Fig. 15(a), and, after being compared to the different weighting patterns of Fig. 15(b), the notes are very clearly identified in Fig. 15(c) when the degree of coincidence between the profile of the segment being analyzed and a particular weighting pattern is high. Examiner contends that even if Fig. 15 did not clearly show the identification of notes, which it does, the Appellant's concession above amounts to an admission that Fujishima determines a first note. By generating a frequency spectrum in which the frequency components which correspond to musical note pitches are larger than other frequency components, notes are necessarily determined.

Appellant states that one of the limitations in claims 1 & 15 describes "determining a first note from the identified musical notes in the plurality of data records as a function of their respective strengths." Appellant appears to be arguing that because Fujishima is basing its analysis on one musical segment, this limitation is not met. However, one musical segment is part of the plurality of musical segments that form the whole waveform (see '502, column 6, lines 43-67 & column 7, lines 1-9). By

determining a first note from the identified musical notes in one data record as a function of their respective strengths, Fujishima is determining a first note from the identified musical notes in the plurality of data records as a function of their respective strengths. Appellant appears to be reading far more into this limitation than can be reasonably interpreted from the language of the claim.

Appellant argues that Fujishima does not describe "selecting at least a second and a third note from the identified musical notes in the plurality of data records as a function of the first note." However, Figs. 15(a) and 15(c) clearly show the determination and selection of three notes, respectively, and column 10, lines 62-66 describes the fact that all notes are inherently functions of all other notes, in that notes are based upon a reference tone pitch, such as A4 (440 Hz). Further, Fig. 15(b) shows that chords are formed by three or more notes and are based upon a root note (see left column: C, C#). Since the other two notes in the chord are based upon (i.e., functions of) the root note, Fig. 15(c), which is the result of the inner product of profile PF (shown in Fig. 15(a)) and a weighting pattern from Fig. 15(b) that has a high degree of coincidence, shows that Fujishima is in fact selecting at least a second and a third note from the identified musical notes in the plurality of data records as a function of the first note. The fact that these notes are all selected from one data segment is irrelevant, given the language of the claim, since the one data segment is part of the plurality of data segments (or data records). As such, selecting three notes in a singular data segment is equivalent to selecting three notes in the plurality of data records.

Appellants argue that Fujishima does not determine the key by comparing the respective strengths of the at least second and third notes. Examiner agrees—hence, the combination of '502 and '486, as Appellant quoted: "'502 determines the chord based on a comparison of the respective strengths of the notes (column 7, lines 27-53), and '486 determines the key on the basis of chord information (see abstract)." In response to Appellant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Andrew Millikin

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Lincoln Donovan

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SUPERVISORY PATENT EXAMINER